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PROTOTYPING A TOW LINE CONVEYOR WITH BLUETOOTH CONTROLLER USING LINE TRACING ROBOT SPECIFICATIONS

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ABSTRACT

Tow line conveyors are widely used in various industries, warehouses and distribution centers. For light weight irregular shaped products, a tow line conveyor can be built with the combination of desired shaped carrier and line tracing robot mechanism. The line tracing robot's movement is controlled using micro controller and the conveyor can be operated by attaching a Bluetooth module with the main circuit of the tow line conveyor. The on-floor prototype which is created for the research purpose can be applied for industrial use in any small industry which will result in a more economic and user friendly tow line conveyor. By increasing the capacity of the power source and the area of the carrier of the conveyor, medium to large irregular products can also be transported. The hardware design, circuit design, programming and the control techniques of the prototype of tow line conveyor are discussed in this paper.

KEYWORDS: Tow Line Conveyors, Line Tracing Robot, Prototyping Line Following Robot, Line Tracing Robot Specifications

INTRODUCTION

Towline conveyors has a wide variety of industrial applications because of its advantage to carry out irregular shaped products on a mobile cart. Conveying some products can be difficult in the industry due to their shape, configuration or size. The Towline Conveyor system can be designed with on-floor or in-floor tracks. A typical example would be large four-legged furniture items [1]. On-floor conveyors are attached to the floor surface and without human assistance or driving the conveyor the products can be delivered in desired area of the industry or warehouse. The drive unit may be situated in a "pit" or mounted above the floor. If mounted above the floor, provisions must be made where the cart crosses the conveyor path.

For light weight product in industry, a tow line conveyor can be build using line tracing robot specifications with a cheap Bluetooth controller. This would be much economic and easily adaptable in comparison with traditional tow line conveyors and the conveying bucket over the line tracing mechanism of the tow line conveyor can be customized into any irregular shape. For this research a prototype of on-floor conveyor was built which followed the line on the floor (on the PVC board in this prototyping stage) and carry any item on its carrier. The line tracing robot algorithm is used with microcontroller and some sensors to control the movement of the conveyor. A Bluetooth Module was also added in the conveyor to stop or resume using any Bluetooth device or any smartphone.

LITERATURE REVIEW

There have been a lot of research in the field of towline conveyors. For the last several years the towline conveyers have been playing a vital role in the successful automation of industries, warehouse and distribution facilities. The use of automation and robotics in the field of conveyors is now a common practice. Research into autonomous driving using smaller robots typically follows one of two approaches. In the first approach a mathematical model of the vehicle and its surroundings is generated, tested in simulation, and then applied to a robot built specifically for the purpose [2] [3]. In the second approach a combination of a visual servoing system and a kinematic model is used, again the robot is typically designed around the solution technique [4].

George DevolJr, in 1954 developed the multi jointed artificial arms which lead to the modern robots. But mechanical engineer Victor Scheinman developed the truly flexible arm known as the Programmable Universal Manipulation Arm (PUMA) [2]. Mobile Robotics moved into its own in 1983 when Odetics introduced this six-legged vehicle which was capable of climbing over objects. This robot could lift over 5.6 times its own weight parked and 2.3 times it weight moving. [3] The history of line tracing robots started when James Cronrniller had designed a simple line following robot with the control system. The project consisted of steering and drives control circuit, which is able controlled by the PIC Microcontroller. An H-bridge circuit was designed to enable the steering.

Hardware Design

The hardware design of the tow line conveyor is mostly concerned with the design of line following robot mechanism as the carrier is variable for different product but the driving mechanism of the robot is constant.

Circuit Block Diagram

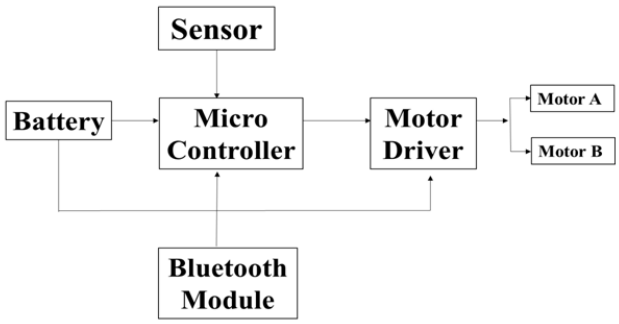

Figure 1: Block Diagram of Line Tracing Circuit of Towline Conveyor Prototype

The sensor senses if the conveyor is on the black line or it has been dislocated from the track and send the signal to the Microcontroller. If the conveyor moves towards left direction from the line, the microcontroller signals the motor driver which gives necessary signal to the right motor to go more in the right direction. Similarly, if the conveyor moves towards right direction from the line, the microcontroller signals the motor driver which gives necessary signal to the left motor to go more in the left direction. The 1300 mah Rechargeable Polymer Lithium battery gives the necessary power to the microcontroller and the motors. The Bluetooth Module receives signal from the Bluetooth device and acts accordingly.

Circuit Design

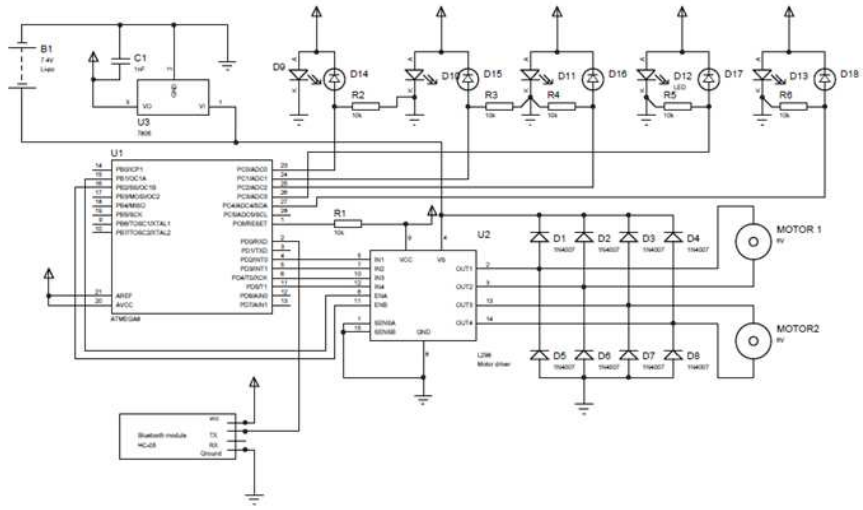

Figure 2: Circuit Design of Line Tracing Circuit of Towline Conveyor Prototype

This is the circuit diagram for the line tracing robot part of the tow line conveyor. IC regulator 7805 (5v) was use and both the IC Transmitters (D9-D13) and Receivers (D14-D18) was of 3v. The Resistors (R1-R6) was of 10k each. The non-polar capacitor was of 22uF.

Components & Tools

Table 1: Componentsrequired

S. No	Name	Model/Type	Rating	Quantity
1	Microcontroller	ATmega8	5v (dc)	1p
2	Bluetooth Module	HC-05	5v(dc)	1p
3	Motor Driver	L298	0-25v,3A	1p
4	IC regulator	7805	5v,1A	1p
5	Battery	Lipo	1300maH,7.4v	1p
6	Dc Motor	-	6v,1A	2p
7	Diode (D1-D8)	1N4007	1A	8p
8	IR Transmitter (D9-D13)	-	3V	5p
9	IR Receiver (D14-D18)	-	3V	5p
10	Resistor(R1-R6)	-	10K	6p
11	Capacitor	Non polar	22uF	1p
12	Carrier	-	-	1p
13	Attaching screw	-	-	4p

Table 2: Tools Required

S. No	Name	Model/Type	Rating	Quantity
1	Soldering Iron	-	220v(ac),60w	1p
2	Soldering Lead	-	-	As required
3	Vero board	-	-	1p
4	Connecting wire	-	-	As required

PROGRAMMING

All the programming was done in C programming language. Atmel Studio 6.0 compiler was used to compile the programming.

The main programming part for the micro controller is as follows:

```
int main(void)
{ motor_init();
 adc_init();
  rec_init();
sei();
while(1)
{
//MotorA(2,200);
//receive();
linefollow();
//_delay_ms(50);
//TODO
}
}
```

For controlling the Bluetooth module this programming is also included in the micro controller:

```
ISR(USART_RXC_vect)
{
char ch=UDR;
char ph;
if (ch=='l')
{
while(1)
{
MotorA(0,0);
MotorB(0,0);
while(!(UCSRA & (1<<RXC)));
```

```
        ph=UDR;
        if (ph=='d')
        {
        break;
                        }
                }
        }
}
```

CONTROL OF THE CONVEYOR

Manual Control

The Towline Conveyor can be controlled manually with its on/off switch. The switch is connected with the main circuit. The conveyor is programmed to turn around at the end of any line automatically. No external control is needed for this purpose.

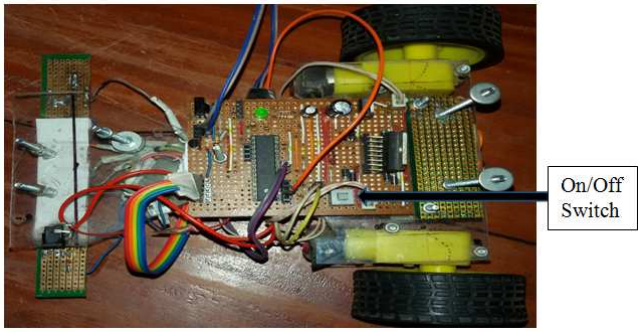

Figure 3: Manual Control of Towline Conveyor

Control with Bluetooth

A Bluetooth Module is attached with the main conveyor circuit so that it can be controlled by Bluetooth. Both “on” and “off” feature is allowed in this automated system. To work in this process, the circuit board of the conveyor have to be activated by using the manual on/off switch. When the switch is on, the Bluetooth module is ready to get any Bluetooth signal. The Bluetooth device has to be paired with the Bluetooth device. Scanning for nearby Bluetooth devices from a Bluetooth device will show the Bluetooth module as HC-05.

CONCLUSIONS

The prototype of the tow line conveyor is a new development platform in the field of conventional industrial transportation system. By increasing the capacity of the motor and the power source/battery the carrying capacity of the conveyor can be increased. There is a lot of opportunity for future development of the prototype which may result in a huge change in industrial transportation system.

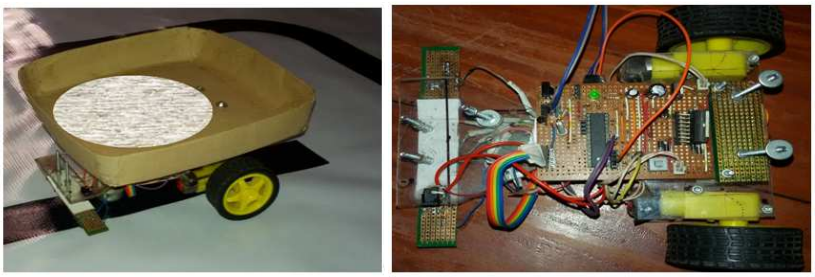

Figure 4: Built Prototype of the Tow Line Conveyor Using Line Tracing Robot Specification

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